

REMARKS/ARGUMENTS

These remarks attend to all outstanding issues in the pending office action of November 25, 2003. Claims 1-21 remain pending in this application. Claims 1 and 18-20 are amended without addition of new matter, as discussed herein below.

1, 2 and 3. Claim Rejections – 35 USC § 102

Claims 1, 5-6, 13, 15 and 18-20 stand rejected under 35 USC §102(b) as being anticipated by U.S. Patent No. 4,054,672 to Inoue et al (hereinafter, “Inoue”). Applicant respectfully disagrees, since, among other reasons, Inoue fails to teach each element of the claims as required under 35 U.S.C. §102(b).

Inoue teaches methods of freezing and defrosting food under high pressure wherein spring loaded electrodes sandwich a food item contained in a pressure chamber (See Inoue, FIG. 3; col. 7, lines 11-15) and wherein AC voltage may be applied (Inoue, col. 7, line 16).

Independent claim 1 has been amended to show that the first electrode is embedded into or coated onto an object to be protected from ice formation. Support for these amendments may be found, for example, in Applicant’s specification, on p. 13, lines 6-11; p. 14, lines 11-20; p. 15, lines 13-15, and in FIG. 1. Inoue does not disclose an electrode embedded into or coated onto an object. Instead, as noted above, Inoue discloses a system wherein “a pair of electrodes 13 and 14 slidably mounted through the chamber 1 *sandwich* [sic] the food to be defrosted therebetween *under pressure applied by springs* 15 and 16” (col. 7, lines 11-15, emphasis added).

Claim 1 is further amended to include an upper frequency (300kHz) for operation of the AC voltage. Support for the upper frequency may be found, for example, in U.S. Application PCT US00/05665, filed on March 1, 2000 and titled ‘Methods and Systems for Removing Ice from Surfaces’, from which the immediate application claims priority as a Continuation in Part. See, e.g., PCT US00/05665, page 15, lines 3-4, and page 28, lines 11-16. (Pages 15 and 28 of PCT US00/05665 are attached hereto as Appendix A for convenience.)

Note that Inoue specifies an AC voltage "in excess of 1000MHz" (col. 6, lines 31-37); the system of Inoue thus operates at microwave frequencies, and not at audio frequencies as specified by Applicant's specification (page 6, lines 21-25) and amended claim 1. Inoue thus describes a method that operates using an entirely different principle of physics as compared to the Applicant's method of operation in claim 1.

For the foregoing reasons, we contend that claim 1 is allowable over Inoue, and request reconsideration.

Claims 5-6, 13, 15 depend from claim 1 and benefit from amendments and arguments discussed above. In addition, these claims have additional limiting features that patentably distinguish over Inoue. For example, claim 5 requires interfacial ice located at an ice-solid interface. Nowhere does Inoue teach or suggest the term 'interfacial ice'. Claim 6 requires interfacial ice located in the interelectrode space. Inoue teaches that a frozen food is placed between a pair of electrodes and that the frozen food is defrosted (Inoue, col. 7, lines 7-15). Claim 13 requires that the first electrode to include a conductive grid, and claim 15 requires that the second electrode includes a conductive grid. Inoue teaches that a 'metal screen or textile' can be used between the electrodes and the food (Inoue, Col. 7, lines 20-23); but nowhere does Inoue disclose or teach that a conductive grid is in contact with ice to be removed from a surface.

Claim 18 is amended similar to claim 1 in that it now requires the step of "embedding or coating an object to be protected from ice formation with a first electrode." Claims 19 and 20 depend from claim 18 and are also amended to recite the upper frequency of 300kHz, like claim 1. Thus for reasons argued above, claims 18-20 should also be allowable and, accordingly, we request reconsideration.

In view of the above remarks, Applicant contends that claims 1, 5-6, 13, 15 and 18-20 are allowable over Inoue, and respectfully requests the Examiner's reconsideration and allowance of these claims.

Claims 1 and 3 stand rejected as being anticipated by U.S. Patent No. 4,974,503 to Koch (hereinafter, "Koch"). Applicant respectfully disagrees, since Koch fails to disclose each element of claims 1 and 3.

Koch discloses an apparatus for heating, pasteurizing and/or sterilizing food products using radio-frequency radiation. Applicant's claim 1 serves to melt interfacial ice at an ice interface (see, e.g., p. 3, line 6 of Applicant's specification). Claim 1, as amended, specifically operates in a frequency range between 1 kHz and 300 kHz. In contrast, Koch discloses an apparatus for heating, pasteurizing and/or sterilizing food products using radio-frequency radiation. Koch specifies an operating frequency of 13 – 440 MHz (col. 4, lines 21-17, and claim 5). It is known in the art of food sterilization that proper pasteurization or sterilization of food products demands heating of the core or center of a food, not only its surface. Indeed, Koch cites "...the much greater *depth of penetration* of high-frequency radiation [into food] is particularly noticeable and advantageous" (col. 5, lines 44-48, emphasis added). Koch further discloses that high-frequency radiation is economically effective "to conduct the heat more slowly to the centre of the product...due to the great depth of penetration of such radiation into the product" (col. 5, lines 51-55). Applicant contends that conducting high-frequency radiation or heat to a depth or center of a product is different from melting interfacial ice at an ice interface. Applicant further points out that Koch operates at radio-frequencies (see, e.g., abstract) of 13 – 440 MHz (see also, Koch, col. 4, lines 21-17, and claim 5) whereas claim 1 specifies a frequency range of from 0.5 kHz to 300 kHz. Thus, Koch's principle of operation differs from that of claim 1, and the defined frequency ranges do not overlap.

Furthermore, in light of amendments made to claim 1, Koch does not disclose an electrode embedded into or coated onto a surface. Koch's independent claim 1 recites "...*vertical spacing* of said emitter means *from* said food products...selected in dependence upon a predetermined irradiation power density required by said food product to achieve the desired heat treatment." See Koch, col. 6, lines 30-31, emphasis added; see also Koch, Figure 1, which shows gaps between the electrodes and the food or conveyor.

Given the above arguments and the amendments to claim 1, Applicant respectfully requests withdrawal of the Examiner's rejection and allowance of claim 1.

Claim 3 was also rejected as being anticipated by Koch. Claim 3 is dependent upon claim 1, and thus benefits from the above arguments. Additionally, Koch does not disclose "an electrical insulator located in the interelectrode space," as recited in Applicant's claim 3. Koch shows and describes a vertical distance between the food item to be pasteurized and the radio-frequency electrode; the vertical space is occupied by air and Koch does not discuss air as an electrical insulator (col. 5, lines 9-20; col. 6, line 31). Instead, the vertical space is merely determined by the irradiation power necessary to sterilize the food because "...the radiation power, emanating from the electrode surface decreases with the square of its distance from the surface..." (Koch, col. 4, lines 62-64).

Applicant contends that for at least the reasons laid out above, claim 3 is allowable over Koch. Reconsideration and allowance of claim 3 is requested.

4 - 7. Claim Rejections – 35 USC § 103

Claims 2 and 21 stand rejected under 35 USC §103(a) as being unpatentable over Inoue in view of US Patent No. 5,630,360 to Polny, Jr. (hereinafter, "Polny"). Applicant respectfully disagrees and traverses the rejection. Applicant believes that Inoue and Polny do not render any of the claims *prima facie* obvious, as explained below.

The following is a quotation of from the MPEP setting forth the three basic criteria that must be met to establish a *prima facie* case of obviousness:

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the references or to combine reference teachings. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. MPEP §2142, citing *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

Inoue cannot render independent claims 1 or 18 obvious since, among other reasons, Inoue does not teach each element of claims 1 and 18, as argued above. Claims 2 and 21 depend on claims 1 and 18, respectively. Inoue thus also fails to render 2 and 21 obvious since the elements of these claims are also not disclosed by Inoue.

Moreover, Inoue is non-analogous art to claims 2, 21. MPEP §2141.01(a) states the following regarding obviousness-type rejections: In order to rely on a reference as a basis for rejection of an applicant's invention, the reference must either be in the field of applicant's endeavor or, if not, then be reasonably pertinent to the particular problem with which the inventor was concerned" *In re Oetiker*, 977 F.2d 1443, 1446, 24 USPQ2d 1443, 1445 (Fed. Cir. 1992).

Inoue is neither in the field of Applicant's endeavor, nor reasonably pertinent to the problem with which the Applicant is concerned. The present invention is directed toward *deicing the surface* of a solid object (see Applicants' specification, p. 2, lines 3-4; p. 3, lines 9-11; p. 6, line 18; and p. 9, lines 9-10), examples of such objects include windshields, aircraft wings, automobile tires, roads, bridges, sidewalks, train tracks, shoes, ships, freezer coils, and the like. In Inoue, deicing a food surface will not *defrost* the entire food item. An inventor addressing problems associated with melting interfacial ice, as in claims 2 and 21, would not utilize a reference (Inoue) directed toward preserving food taste and texture throughout a freeze/thaw process.

Polny is cited, presumably, because it discloses an AC power source providing an AC voltage in a range from about 10 volts to 500 volts. However, nowhere does Polny teach a system for melting interfacial ice. Rather, Polny teaches a system "for electroheating, processing, pasteurizing and/or cooking food" (col. 1, lines 17-19), particularly liquid egg (col. 4, lines 58-59; col. 5, lines 1, 5 and 47). Polny relates specifically to uncooked, non-frozen foods. Neither Polny nor Inoue, alone or in combination, teach or suggest every element of Applicant's claim 1 or 18. As claims 2 and 21 depend from independent claims 1 and 18, respectively, neither do Inoue and/or Polny teach or suggest every element of Applicant's claims 2 or 21.

Additionally, there is no motivation to combine Inoue and Polny, as they are non-analogous art to claims 2, 21. Both Inoue and Polny teach methods of modifying and/or improving food products. Inoue discloses defrosting food products. Polny describes pasteurization or sterilization of a food product (liquid egg). There is no motivation to combine Inoue and Polny in a non-culinary capacity.

Furthermore, both references require treating the food product at depth, rather than removing ice from its surface, in order to achieve their objectives. For example, the removal of ice from the surface of a food product is insufficient to defrost a food item (an objective of Inoue). The treatment of a surface of a food product is insufficient to pasteurize or sterilize the food product (objective of Polny), as pasteurization and sterilization require treatment of the whole product, including its center. The inventions of both Inoue and Polny would be inoperable if they did not penetrate food items at great depth. An inventor seeking to remove or melt interfacial ice (e.g., present claims 2, 21) would not look to Inoue and Polny, either alone or in combination, with an expectation of successfully achieving his objective.

The combination of Inoue and Polny fails to teach every element of the Applicant's independent claims 1 and 18 and, thus, also fails to teach every element of Applicant's claims 2 and 21. Furthermore, the references are non-analogous art to claims 2, 21 and lack both the motivation and expectation of success required for a 35 USC §103(a) rejection. Applicant respectfully requests withdrawal of the Examiner's rejection, and further requests allowance of claims 2 and 21.

Claims 7-9 stand rejected under USC §103(a) as being unpatentable over Inoue in view of US Patent No. 6,239,601 to Weinstein (hereinafter, "Weinstein"). Again, Inoue neither teaches nor suggests the elements of Applicant's claim 1. Claims 7-9 depend from claim 1. Applicant respectfully disagrees with the Examiner's rejection for at least the following reasons:

The Examiner cites Weinstein, stating that Weinstein discloses an interelectrode distance having a value in a range of about 50 µm to about 500 µm. However, Weinstein teaches a "thickness measurement device and method that determines the thickness of a layer of ice" (col. 1, lines 55-56). Nowhere does Weinstein teach or suggest "a system for melting interfacial ice" as recited in

Applicant's claim 1. As claims 7-9 depend from claim 1, Applicant submits neither Inoue nor Weinstein, alone or in combination, teach or suggest all of the elements of Applicant's claims 7-9.

In view of the above arguments, Applicant respectfully requests withdrawal of the Examiner's objection, and further requests allowance of claims 7-9.

Claim 14 stands rejected under USC §103(a) as being unpatentable over Inoue. The Examiner submits that Inoue discloses substantially all features of the claimed invention including a conductive grid. The Examiner further states that it would be obvious to make a conductive grid of metal strips. Applicant respectfully disagrees that Inoue renders claim 14 obvious and traverses the rejection. As discussed above, Inoue does not teach an electrode embedded into or coated onto an object, as is described in Applicant's claim 1. Claim 14 depends indirectly from claim 1, which Applicant contends is allowable over Inoue, and therefore benefits from the arguments presented above.

In light of these remarks, withdrawal of the Examiner's rejection and allowance of claim 14 is requested.

8 and 9. Claim Objections

Applicant appreciates the indication of allowable subject matter in claims 4, 10-12, 16-17. In view of the foregoing, Applicant respectfully requests withdrawal of the Examiner's objection and allowance of all claims.

Conclusion

In view of the above Amendments and Remarks, Applicant has addressed all issues raised in the Office Action dated November 25, 2003, and respectfully solicits a Notice of Allowance. Should any issues remain, the Examiner is encouraged to telephone the undersigned attorney.

A Petition for 1 month's extension of time to reply indicating authorization to charge the required fee of \$110 to Deposit Account 12-0600 is submitted herewith, thus extending the period for reply up to and including 25 March 2003. Applicant believes no further fees are due, however, if any additional fee is deemed necessary in connection with this Response, please charge Deposit Account No. 12-0600.

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Respectfully submitted,

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APPENDIX A

to the Response to the Office Action mailed March 8, 2004 in U.S. Serial No. 09/976,210, entitled HIGH-FREQUENCY MELTING OF INTERFACIAL ICE

coating to AC and, particularly, by increasing the AC voltage and frequency, as indicated by Equation (4) above.

A coating may be used containing a lossy dielectric material having a maximum dielectric loss at higher frequencies, in a range of from 0.5 to 300 kHz. When an AC

5 current in the conductor has a low frequency in a range of from 40 to 500 Hz, there is virtually no energy dissipated as a result of dielectric heating. When the AC current has a frequency near its maximum dielectric loss frequency, then heating occurs. By switching between high and low AC frequencies, the heating can be switched "on" and "off". The heating power for a given dielectric coating material and set of operating

10 conditions is calculated using Equations 2 - 5, above. The strong dependence of heating power of dielectric coatings on the frequency shows why the power line is heated when, for example, 6 kHz voltage is applied instead of 60Hz AC. High frequency AC current may be supplied using a separate AC power supply as a power source. Or, frequency multipliers as known in the art may be used to multiply the

15 output of a low-frequency power supply to make high-frequency AC current. A sketch of a representative electrical circuit diagram of an embodiment using high-frequency AC current to deice a power line in a 2-phase system is shown in FIG. 11. In FIG. 11, a power line supply 440 at 230 kV and 60 Hz is connected to a first power line 442 and a second power line 444. On the other end, a user 446 is connected to power lines

20 442, 444. First power line 442 includes circuit unit 447 comprising inductance 448 in parallel with capacitance 450. First power line 442 also includes series unit 453, comprising inductance 454 in parallel with capacitance 456, which is in series with circuit unit 447. A coating power supply 452 operates at 6 kHz with a voltage of 23 kV.

Coating power supply 452 is connected to first resonance contour 458. First 25 resonance contour 458 is connected to power line 442 between the two series circuit units 447 and 453. Coating power supply 452 coupled to a second resonance contour 460, which is connected to second power line 444. The two resonance contours, 458 and 460, are used to prevent a 6kHz voltage from passing to the 60Hz power supply 440 and user 446.

30 FIG. 12 shows an example of an embodiment containing a conductive shell.

FIG. 12 depicts a cross-sectional view of a power line 500. The power line 500

101. A method as in claim 100, further comprising operating a switch for controlling said shorting.
102. A method as in claim 96, further comprising conducting high-frequency impedance measurements to detect ice.
- 5 103. A method as in claim 96, wherein said coating is ice, and further comprising frequency-tuning said high-frequency AC current to match ice dielectric heating and skin-effect heating.
104. A method as in claim 96, wherein said coating is ice, and further comprising varying said high-frequency AC current to change the heating pattern produced by standing wave effects.
- 10 105. A method of preventing ice and snow on a surface of an object, comprising:
providing an electrical conductor integral with said surface, said conductor configured to generate an alternating electromagnetic field in response to an AC current;
- 15 flowing a high-frequency AC current having a frequency in a range of from 0.5 to 300 kHz.
106. A method as in claim 105, further comprising a coating of ice on said surface.
107. A method as in claim 105, wherein said object is a power line.
108. A method as in claim 105, further comprising switching off said high-frequency
- 20 AC current.